ECONOMIC BENEFITS OF URBAN WETLAND CREATION FOR WELLBEING

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Final report
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This document has been prepared for WWT by:

Economics for the Environment Consultancy Ltd (eftec)
10F Printing House Yard
Hackney Road
London E2 7PR
www.eftec.co.uk

Study team:

Ian Dickie
Natalya Kharadi
Allegra Naldini

Reviewer

Ian Dickie
Rob Tinch

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Disclaimer

Document evolution

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Executive summary

This report presents a scoping analysis of the natural capital benefits of creating 25,000 ha of urban wetlands for wellbeing in Great Britain (GB) by 2050. The creation of urban wetlands can increase access to blue spaces of those living in urban areas where access to nature is often inadequate (WWT, 2022). The costs and benefits associated with creating urban wetlands are estimated. Delivering these wetlands would have multiple ecosystem services benefits, as well as financial costs and other costs (e.g. opportunity costs).

WWT are calling for the creation of 100,000 hectares of new and restored wetlands in the UK by 2050, to make a real difference to nature recovery and to restore the critical ecosystem services and functions provided by wetlands.

The natural capital account (NCA) presented in this report is part of WWT's Roadmap to 100,000 hectares work, which aims to assess both the spatial and economic potential for large-scale wetland restoration targeted at tackling some of the key issues faced by UK society. The work has a particular focus on four themes where wetlands can provide solutions, namely (1) wetlands for carbon storage (specifically saltmarsh for blue carbon), (2) wetlands for urban wellbeing (detailed in this report) (3) wetlands for flood resilience and (4) wetlands for water quality.

The NCA and accompanying reports have been developed separately for each of the four themes (focussing on 25,000 ha of wetland creation targeted at each theme). The accounts can also be aggregated to value the benefits provided by all 100,000 ha of wetlands in the WWT ambition. These aggregated benefits, together with a summary of all four accounts, are presented and discussed in the main project technical report, while detailed reports are provided separately for the individual accounts (such as this).

The analysis supporting the accounts ensures they can be aggregated with a low risk of double counting because (1) there is little overlap in the target wetland areas, (2) a wider potential wetland area providing similar benefits has been identified for each account, and (3) the approach taken in estimating costs and benefits are consistent across accounts. The account results do not show exactly where to create wetlands. They show the feasible returns to society from a realistic wetland creation strategy.

Only a selection of these benefits has been quantified and valued in this analysis, and further research is needed to increase the certainty of results and understand a wider range of benefits. Nevertheless, the results show substantial potential benefits from urban wetland habitat creation across GB.

The analysis of these benefits has followed Defra's ENCA guidance where relevant and aligns to HM Treasury green book appraisal principles. The total gross benefits are estimated at

£5.7bn over 60 years. The benefits in this account are predominantly public goods, including recreation, mental and physical health benefits which reduce costs for public bodies such as health care trusts, the NHS, and local authorities. This could incentivise them to contribute to urban wetland creation and maintenance costs. Other benefits have potential market value, such as additional carbon sequestration. Development of these funding approaches requires further research.

As shown in the account results (Table ES 1), urban wetlands have multiple benefits, but the predominant purpose of these wetlands is to improve the wellbeing of people living in urban areas. Benefits to the wellbeing of urban populations has been shown through the large recreational and physical health benefits provided by wetlands, as well as the urban cooling benefit provided by wetlands to urban populations. The mental health benefits are smaller than the other quantified benefits estimated in the account because they are only quantified for people with mental health conditions, which is a smaller part of the population than those benefitting from improving their physical health. However, this is nonetheless an important service provided by urban wetlands, and as it is not possible to quantify wider mental health benefits, such as reducing stress and improving mood in visitors without an MHC diagnosis, the estimated mental health benefit is likely to be a significant underestimate.

Table ES 1 Natural capital asset valuation and liabilities associated with the creation of 25,000 ha of urban wetlands for wellbeing across GB (assessed over 60 years in present value terms). Red figures in brackets represent negative values (costs). All figures are in £m.

2024 prices	Valuation metric	Value to businesses	Value to the rest of society	Total
Asset values (monetised)				
Carbon	Value of CO_2e sequestered by wetlands	-	632	632
Recreation	Welfare value for created wetland	-	2,808	2,808
Mental health	Avoided medical treatment costs of MHC cases	-	37	37
	Avoided productivity loss costs of MHC cases	32	-	32
Physical health	Avoided medical treatment costs	-	1,117	1,117
Urban cooling	Value of temperature regulation	1,074	-	1,074
Total gross asset value	**Mix of values**	**1,106**	**4,594**	**5,700**
Liabilities				
Wetland creation costs[2]		(272)	-	(272)
Wetland maintenance costs		(74)	-	(74)
Total net asset values (monetised)		**760**	**4,594**	**5,354**
Other material unquantified benefits				
Water quality				
Water supply				
Flood mitigation				
Biodiversity				

Table notes:
[1] Value of carbon sequestered increase over time in line with HM Treasury Appraisal Guidance (DESNZ, 2023)
[3] Costs that are necessary to produce benefits (e.g. urban wetland habitat creation and maintenance costs).

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1 Introduction

The creation of urban wetlands can increase access to blue spaces of those living in urban areas where access to nature is often inadequate (WWT, 2022). Urban wetlands provide blue spaces at different scales including (1) wetlands at the city/town level, such as new or restored urban parks centred on lakes, streams and ponds, (2) wetlands at the neighbourhood level, such as streams and ponds, (3) mini-wetlands at the individual property level, such as garden ponds and drainpipe wetlands, and (4) wetlands at the street or development level, such as rain gardens, swales and small ponds (WWT, 2022).

1.1 Project objectives

This project aims to support WWT's ambition to create 100,000 hectares of new and restored wetland habitat in the UK by 2050, to make a real difference to nature recovery and to restore the critical ecosystem services and functions provided by wetlands in the UK.

To achieve this 'Blue Recovery', WWT have published proposals for wetland solutions focussed on four key themes:

1. Wetlands for water quality
2. Wetlands for carbon storage
3. Wetlands for urban wellbeing
4. Wetlands for flood resilience

Each proposal details the partnerships and policy frameworks required to reach the 100,000 ha target, laying out the steps needed to move from small-scale, ad-hoc wetland creation to a strategic network of larger, connected wetlands that maximise benefits to society.

WWT's Roadmap to 100,000 hectares work aims to assess both the spatial and economic potential for large-scale targeted wetland restoration. Specifically, it involves:

- Mapping both the spatial demand for wetlands and suitable areas for wetlands designed to address these themes, for example, via natural flood management wetlands, constructed treatment wetlands, community urban wetlands, sustainable drainage systems or saltmarsh creation;
- Quantifying, through natural capital accounting, the scale of the potential benefits provided by large-scale, targeted wetland creation - benefits that are often underappreciated in considerations of wetland policy options; and
- Developing resources and engagement materials to demonstrate this potential.

Natural capital accounts (NCA) have been developed to estimate the multiple benefits of

creating wetlands for each theme:

- **Wetlands for carbon storage (saltmarsh blue carbon).** The NCA for saltmarsh creation for carbon storage focuses on the carbon sequestration benefit from the creation of saltmarshes in the UK.
- **Wetlands for urban wellbeing**. The NCA for urban wellbeing wetlands detailed in this report, focuses on benefits, such as recreation, physical and mental health, and urban cooling, from the creation of freshwater wetlands near urban areas.
- **Wetlands for flood resilience**. The NCA for flood resilience wetlands focuses on benefits such as flood risk management, food provision, air quality regulation, carbon sequestration, recreation, and physical health.
- **Wetlands for water quality**. The NCA for water quality wetlands focuses on the water quality benefits provided by freshwater wetlands located in areas with particularly poor water quality. The benefits included are food provision, water quality, and recreation.

Assessing the benefits provided by wetlands also highlights the beneficiaries from the creation of these wetlands, and hence who could invest in the capital and maintenance costs associated with creating these wetlands. For example, water companies, may be interested in providing capital investment in the creation of wetlands that reduce surface water flooding and hence overflow at wastewater treatment plants, whilst health care trusts may be interested in funding the operational investment required to ensure that a wetland attracts visitors, which has physical and mental health benefits to the local population.

The remainder of this report provides evidence to demonstrate the value associated with creating urban wetlands targeted at improving wellbeing. To do this, a natural capital account has been developed for a target area of potential urban wetland creation in the UK. The account organises data on wetlands that would be created, the services they support, the value of the benefits they provide to people, and the distribution of those benefits across businesses and society into the future. These benefits are compared to the costs of urban wetland creation in a balance sheet.

1.2 Project scope and consistency across accounts

In line with WWT's ambition to create 100,000 ha of wetland in the UK by 2050, the scope of this project is to estimate the multiple benefits of creating 25,000 ha of wetlands for each of the four themes. Although the natural capital accounts (NCA) and accompanying reports have been developed separately for each theme, these accounts can be aggregated to value the benefits provided by all 100,000 ha of wetland.

The analysis supporting the accounts ensures they can be aggregated with a very low risk of double counting, because there is:

- **Little overlap in target wetland areas**. The areas of wetland creation targeted in each account have been mapped according to criteria that identifies the areas most suitable

to fulfilling the primary purpose of that wetland (i.e. flood resilience, urban wellbeing, water quality improvement, and saltmarshes). Although it is feasible that an area may be well suited to wetlands that provide both for example, flood resilience and an improvement in water quality, it has been found, by overlaying the target wetland areas in each account, that the areas targeted for these specific purposes do not overlap. This therefore reduces concerns of double counting the benefits of wetland creation across the accounts.

- **Wider potential wetland area providing similar benefits**. Each account has identified a larger potential wetland area than the 25,000 ha priority area actually covered by the account. Although benefits have been estimated for defined target wetlands, the benefit values applied are generally averaged at the regional or national scale rather than being spatially explicit at the site level. This means that the calculated benefits are not tied to specific locations within the target area, but rather represent a typical value that could be achieved at other wetland sites if the sites we have mapped to demonstrate the vision were not available. This includes if they were not available because they were used for a different theme. As a result, even if two accounts identify overlapping target wetlands, there are alternative locations that could be used, so there is no double counting of the benefits. This is because the values used are not dependent on the exact site but reflect the typical benefits that could be realised in various potential locations. Therefore, if a wetland were moved from one location to another within the wider potential area, the values they generate would not be compromised. The account results do not prescribe specific locations for wetland creation; instead, they illustrate the potential societal returns from implementing a realistic wetland creation strategy across a broader landscape.
- **Consistency in approach**. The approach taken in estimating the costs and benefits are consistent across accounts, allowing for aggregation across accounts. The accounts have monetised costs and benefits based on a 2024 price year and have projected costs and benefits over 60 years. All accounts have assumed that an equal area of wetlands is created each year between 2024 and 2050 (i.e. the year in which the target area of wetland creation is achieved).

1.3 Structure of this report

This report documents the approach taken and the key results, including data gaps and uncertainties, for the water quality wetland natural capital account. The structure of the report is as follows:

- **Section 1: Introduction –** introduces the project objectives and outputs.
- **Section 2: Approach** – provides an overview of the natural capital analysis and its application to urban wetland creation the UK.
- **Section 3: Scope of the natural capital account** – defines the spatial boundary, asset register, benefits, and presentation of results.

- **Section 4: Summary of the analysis** – describes the analysis used to build the NCA.
- **Section 5: Results** – presents the UK urban wetland creation benefits results.
- **Section 6: Conclusions and recommendations** – summarises the results of the NCA and provides interpretation of the results and next steps.
- **Appendix 1: Benefit methodologies** – details the quantification and economic valuation methods used to produce the results reported.

2 Approach

This section provides a description of the natural capital accounting method used and the approach taken to develop an account for urban wetlands in GB.

2.1 Natural capital accounting

Natural Capital is "the stock of renewable and non-renewable natural resources (e.g. plants, animals, air, water, soils, minerals) that combine to yield a flow of benefits to people"[1]. A natural capital approach can be defined as distinguishing between the natural capital stocks and the flows of benefits they provide; projecting benefits into the future and linking the provision of benefits to the extent and condition of assets. The intention is to ensure that business decisions prioritise maintaining the assets to maintain benefits, and not to maximise one of the benefits at the expense of others or the natural capital asset itself.

Systematic and consistently generated evidence and repeated updates are what distinguish accounting from one-off assessments. Accounting offers comparability across space and time, bringing rigour to the presentation of data on natural capital assets, the services they provide, the benefits and hence value of those services, and the distribution of those benefits across society and into the future.

The approach to developing the urban wetlands account is based on the Corporate Natural Capital Account (CNCA) framework for the Natural Capital Committee in 2015 (eftec, RSPB, pwc, 2015). This framework is also the basis of BSI:8632 on Natural Capital Accounting for Organizations[2]. Natural capital accounting involves producing a natural capital balance sheet and a natural capital income statement mirroring traditional financial accounting. The intention is to present information to the decision makers in a format they are familiar with so that the impacts and dependencies on the natural capital is considered more explicitly and in conjunction with other forms of capital.

The **natural capital balance sheet** has two parts: asset values (of the benefits natural capital produce for businesses and wider society) and liabilities (on what needs to be spent to create and maintain natural capital). The natural capital balance sheet and its supporting schedules answer five key questions:

I. What assets do we own and/or manage?

II. What benefits do they provide and to whom?

III. What are these benefits worth?

IV. What does it cost to maintain the assets?

[1] Source: Natural Capital Protocol *https://naturalcapitalcoalition.org/natural-capital-protocol/*

[2] Available at: *https://shop.bsigroup.com/products/natural-capital-accounting-for-organizations-specification?pid=000000000030401243*

V. How do costs compare to benefits over time?

The following supporting schedules hold the information gathered to answer the above questions:

- **Natural Capital Asset Register –** which records the stock of natural capital assets in terms of their extent, condition, and spatial configuration (e.g. size and status of designated sites). These indicators help determine the health of natural capital assets and their capacity to provide benefits[3].
- **Physical Flow Accounts –** which quantifies the benefits that the assets deliver in physical terms. The changes in the quantity / quality of the assets and their benefit provision over time are also shown.
- **Monetary Flow Accounts –** which estimates the economic value of the benefits in monetary terms and discounts the projected future flow of these benefits to provide the present value for the assets. This uses data from actual markets and other (non-market) values. The value of the benefit should be net of the cost of producing the benefit.
- **Natural Capital Liabilities Account –** which details the costs of activities required to sustain the capacity of the natural capital assets to provide benefits over the long term, including management actions for the habitats identified in the asset register.

The monetary flow and cost accounts distinguish values to businesses from values to the rest of society. These supporting schedules provide all the data required for the balance sheet which compares the asset values to the costs of maintaining those values.

Where understanding and evidence allow, calculation of assets and liabilities can take account of expected changes to future costs and benefits of management, and external factors such as population growth or climate change. Otherwise, caution is needed when interpreting the bottom line of natural capital balance sheet – as BSI 8632 states, a positive net asset value is not necessarily an indication of sustainable asset management.

2.2 Preparing natural capital balance sheet for urban wellbeing wetlands

This analysis includes both a natural capital benefits account, which relates to Steps I – III above, and a natural capital liabilities account, which relates to Steps IV – V. The benefits and liabilities have been estimated for urban wetlands within the accounting boundary. The method used to define the accounting boundary is explained in Section 3.1.

The structure of the account allows calculations to link data on the extent of the assets identified in the asset register, to value data on flows of ecosystem services, through the process shown in Figure 2.1. The product of quantity and unit value gives an estimate of

[3] The natural capital asset register is also the basis for scoping the natural capital risk register, and for a materiality assessment (see Section 4) to determine the content of the flow and liabilities accounts.

annual value. Asset values are calculated by summing the expected future annual values of benefits over 60 years, discounted according to HM Treasury (2020) Green Book Guidance.

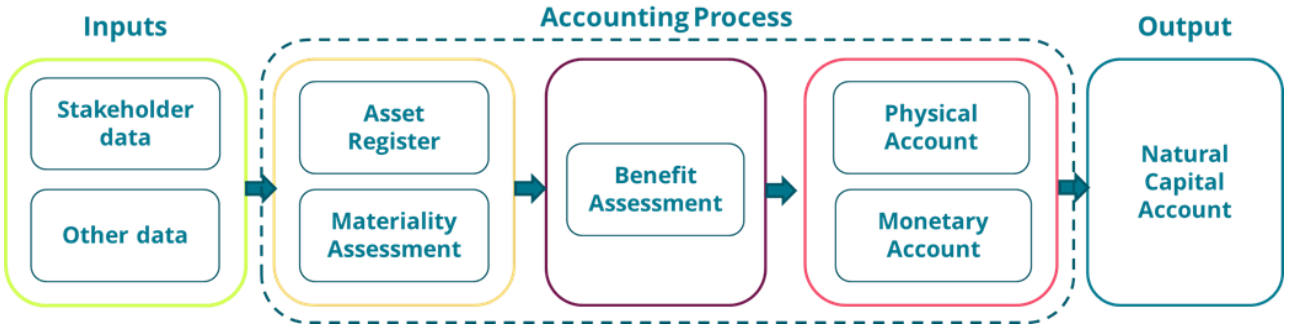

Figure 2.1: Outline of accounting process.

The balance sheets for the creation of urban wetlands are presented in Section 5. The assumptions and evidence used are provided in Appendix 1.

3 Scope of the natural capital account

Scoping of the account defines the spatial boundary of the account, the natural capital assets and the benefits covered and presentation of results.

3.1 Spatial boundaries and asset register

The spatial boundary for the urban wetland creation account is Great Britain (which includes England, Wales, and Scotland). The intended spatial boundary of the account was the UK, but due to limited open-source data for Northern Ireland, the spatial boundary was reduced to only include GB.

The natural capital assets are defined by the extent of areas suitable for urban wetland creation which has been mapped by WWT. Full mapping methods, including data sources, are available in the accompanying technical guidance document (Section 2; Appendix III). In summary, this involved two main steps:

Step 1. Selecting census areas with high 'demand' for urban wetlands for wellbeing:

'Demand' areas were defined as: LSOAs[4] classed as urban for England and Wales (Defra, 2013); and Data Zones in Class 1 and 2 areas (large urban areas and other urban areas respectively) for Scotland (Scottish Government, 2014). Census areas that met these criteria were combined into a single GB-wide wetlands for urban wellbeing 'demand' layer.

Step 2. Identifying suitable locations for urban wellbeing wetlands within priority 'demand' census areas

The potential locations for urban wellbeing wetlands are based on topographic wetness, which identified locations within the 'demand' areas with a tendency to accumulate water. This method is described in detail in the technical guidance document, together with the data sources used.

The resulting locations were then refined based on:

- **Proximity to urban areas**. This identified the areas suitable for freshwater wetlands in proximity to built-up areas.
- **Existing accessibility.** This identified the areas suitable for freshwater wetlands in proximity to existing (on-foot) access routes or existing accessible greenspaces.
- **Exclusion of infrastructure**. This excluded the creation of wetlands in areas that are unlikely to be developed into wetlands based on existing infrastructure such as roads, buildings, and power lines, as well as existing surface water bodies.
- **Spatial requirements**. A minimum size threshold for urban wetlands of 0.4 ha was

[4] Lower layer Super Output Areas (2011)

applied due to the resolution of the underlying data. As such, this account is based on the creation of wetland creation above this size, whereas urban wetlands can also include smaller wetlands e.g. SuDS, that could not be mapped in detail. Opportunity mapping by WWT highlights larger areas (UK census areas) where a range of urban wetland types, including small community wetlands, could be prioritised.

A maximum size threshold for urban wetlands of 100 ha was also applied based on the assumption that wetlands larger than this size are likely to be situated on the rural fringes of urban areas, which may also be less accessible than wetlands located within urban boundaries. This also makes them less accessible to urban populations, and hence the wellbeing benefit provided by wetlands would not be extended across the population. A larger number of smaller wetlands also allow the benefits of urban wetlands to be provided to more communities.

This exercise identified an area greater than the target urban wetland creation area of 25,000 ha. In this analysis, the creation area for NFM wetlands (25,000 ha) has been distributed across the UK, according to the population in each country, as shown in **Error! Reference s ource not found.**. A pro rata distribution of wetlands means that the benefits will be distributed to people across GB, rather than concentrated in a specific region.

Table 3.1: Urban wetland creation area per country based on population.

Country	Population	% of population	Target urban wetland area allocation (ha)
United Kingdom	67,081,234	100%	25,000
England	56,550,138	84%	21,000
Scotland	5,466,000	8%	2,000
Wales	3,169,586	5%	1,250
Northern Ireland	1,895,510	3%	750

Table note: Due to a lack of data on Northern Ireland, urban wetlands in Northern Ireland are included in the asset register but the exact location of these wetlands have not been mapped.

Step 3: **Refining the list of potential wetland locations to meet the target area for urban wetlands for wellbeing creation.**

The potential locations for urban wetland creation were refined to meet the target areas for urban wetland creation in each country (excluding Northern Ireland) using the following prioritisation criteria:

- **Neighbourhood Flood Vulnerability Index (NFVI).** Wetlands targeted at flood resilience in urban areas, for example, via SuDS, are likely to have a bigger impact on

wellbeing in neighbourhoods with higher neighbourhood flood vulnerability (Sayers, Horritt, Penning Rowsell, & Fieth, 2017). The NFVI is calculated on a continuous scale, with higher values representing more flood vulnerable neighbourhoods (i.e. communities experiencing a greater loss in wellbeing when floods occur) (Sayers, Horritt, Penning Rowsell, & Fieth, 2017).

Half of the potential urban wetland creation area was prioritised within 'demand' census areas with the highest NFVI values: those most susceptible to and least capable of dealing with flooding.

- **Accessible natural greenspace**. Within the half identified using the NFVI, half the area needed to meet the wetland creation target area in each country was identified according to the areas with the lowest accessibility to greenspace, and hence with the highest need of a green and blue space (i.e. wetlands).
- **Mental Health indicator**. Census areas were ranked using data on the rate of mental health conditions in the population, which is available for all census areas. Data included: the percentage of registered patients with a diagnosis of depression for England (Daras & Barr, 2021); GP-recorded mental health conditions (rate per 100 people) for Wales (Welsh Government, 2022); and the proportion of the population being prescribed drugs for anxiety, depression or psychosis, for Scotland (Scottish Government, 2020).

  Within the area identified according to the accessible natural greenspace prioritisation described above, the remaining wetland area needed to meet the target in each country was filtered according to the areas with the highest rates of mental health conditions.

This prioritisation process identified the target urban wetland creation areas in Great Britain based on where wetland interventions would be as effective as possible at tackling the UK's wellbeing crisis.

The asset register includes the potential area of urban wetland creation, which includes the total area in which urban wetlands could be created, as well as the target area of urban wetland creation, which includes the highest priority areas for wetland creation based on the criteria detailed above.

3.2 Benefits

The list of potential benefits to assess reflects the list of individual benefits included in Defra (2020) 'Enabling a Natural Capital Approach' (ENCA). This includes:

- Food provision
- Fishing (commercial)
- Timber
- Water supply
- Recreation
- Physical health
- Education
- Volunteering

- Renewable energy
- Carbon sequestration
- Air quality regulation
- Flood risk management
- Noise reduction
- Temperature regulation
- Amenity
- Biodiversity
- Soil
- Water quality
- Landscape
- Non-use values

Further to this list, minerals, other fibres and materials as well as mental health benefits are also considered.

A subset of these benefits has been included in this account, based on expert judgement on the material benefits provided by urban wetlands and on the availability of data. The benefits included in this account are also complementary to the benefits being assessed in the other natural capital accounts. For example, although urban wetlands would provide water quality benefits, the account being developed for water quality wetlands will have a more material impact on this benefit.

The methods used to assess these benefits for urban wetland creation in the UK are described in Section 4.2.1 and Appendix 1. The calculations are linked to the location and extent of natural capital assets, as identified in the asset register, described area in Section 4. Monetary valuations are prioritised in the accounts, and cover carbon sequestration, recreation, mental health, physical health, and urban cooling (i.e. temperature regulation) benefits.

The baseline year for the analysis is 2024. Monetary values published in earlier price years are inflated to 2024 values using the latest HM Treasury (2023) GDP deflators. Asset values are estimated using HM Treasury (2022) Greenbook guidance following a declining discount rate and a 60-year assessment period.

3.3 Presentation of results

Information inputted into and results from the account can be presented for different spatial areas and for different beneficiaries. Results can be disaggregated to the countries in the reporting boundary.

For this account the benefits are divided across two main groups of beneficiaries: ‘Businesses’ (i.e. where the value identified is a financial return to a business) and ‘the rest of the society’ (i.e. public benefits to wider society). Businesses are represented by activities (e.g. business premises, outdoor employment).

4 Summary of analysis

This section presents the data for the urban wetland creation account, described in Section 3. The account uses data from the latest available year. It covers the natural capital assets within the accounting boundary. This reflects the areas of potential urban wetland creation in the UK, as well as a subset of these potential areas to reflect the target 25,000 ha.

4.1 Asset Register

The asset register is a registry of all natural capital assets within the boundary of the account. It forms the foundation of the account and records the extent and condition of the assets. In this account the extent of the assets has been quantified, and the condition of the yet-to-be created assets is assumed to be good given that they are being created with the purpose to provide benefits.

In this case, the account is divided between the potential urban wetland creation area and the target urban wetland creation area. The distinction between these is that the former includes the total area in GB where urban wetlands could be created whilst the latter includes the target area that could be created. The potential creation area is used to provide context for the target creation area.

As shown in Table 4.1, the total potential creation area for urban wetlands in GB amounts to 66,722 ha whilst the target creation area for urban wetlands in GB is 24,252 ha. Due to limited data availability, it was not possible to estimate the potential creation area of urban wetlands in Northern Ireland. Nonetheless, the target to create 750 ha of urban wetlands in Northern Ireland has been included in the asset register as it is assumed that benefits will accrue through the creation of these wetlands. Note that the target creation area is slightly above the theoretical target creation area of 25,000 ha to ensure the inclusion of all the mapped wetlands within the prioritised ‘demand’ areas.

Table 4.1: Overview of Asset Register

Country	Potential creation area (ha)	Target creation area (ha)
England	56,968	21,000
Scotland	6,837	2,000
Wales	2,917	1,252
Northern Ireland	N/A	750
United Kingdom	**66,722**	**25,002**

4.2 Natural Capital Asset Values

This section provides a summary of the methods used to estimate natural capital asset values for the creation of urban wetlands in the UK, with further details in Appendix 1. Where possible, the methods described in Table 4.2 are used for all reporting three countries.

4.2.1 Methodology

Table 4.2 provides an overview of the benefits included in the accounts and the methods used to evaluate them. A longer list of benefits was considered for inclusion in the account, based on Defra's natural capital guidance (Defra, 2020). From this list, the benefits shown in Table 4.2 were identified as being material for this. Some material benefits are not quantified (e.g. biodiversity, water quality and supply, and flood risk management), and are noted accordingly in the results. As detailed in Chapter 1, this account is part of a set of accounts that have been developed for each of four themes. Although some of the material benefits from urban wetlands, such as water quality and flood risk management, have not been quantified in this account, these benefits have been quantified for wetlands designed to provide these benefits.

The distribution of benefits between private benefits (e.g. to farmers) and benefits to wider society, are also noted although none of the benefits in this account accrue to business sectors.

Table 4.2: Overview of benefits included in the account.

Benefit	Description	Annual Physical Flow Measure	Monetary Valuation Metric & Method	Beneficiary
Carbon sequestration	Estimated according to UK average carbon sequestration rate (tonnes CO_2 equivalent per hectare) of floodplains, assuming these have a similar carbon sequestration rate to wetlands, and the non-traded price of carbon.	Carbon sequestered in wetlands (tCO_2e/yr)	Non-traded central carbon value DESNZ (2023) £/tCO_2e	Global society
Recreation	Estimated according to the number of additional visits[1] to a created urban wetland based on the area of that wetland and an estimate of the welfare value associated with each visit to fen marshes (as modelled by ORVal and applied to wetlands).	Recreation visits to created wetland (visits/yr)	Benefit to visitors evaluated as total welfare value from (ORVal) tool (Day and Smith, 2018).	Visitor population
Mental health	Estimated according to the avoided mental health condition (MHC) cases from visits to wetlands and the avoided costs from medical treatment of MHC cases and from avoided working days lost due to mental illness.	Avoided MHC cases from visits to nature (no. avoided cases/yr)	Costs avoided from avoided MHC cases	Visitor population
Physical health	Estimated according to the number of active visits to wetlands per year and the estimated quality adjusted life years (QALY) from these active visits. The avoided medical treatment costs are estimated according to the QALYs from active visits, adjusted to exclude the medical treatment costs already estimated in the mental health benefit valuation.	Active visits to nature (no. active visits/yr)	Avoided medical treatment costs	Visitor population
Urban cooling[2]	The estimated temperature change provided by rivers/canals and lakes/ponds on a per ha basis in urban areas and the associated cost savings from a temperature change (estimated based on AC cost savings and productivity loss from lost working days cost savings).	Area of urban wetland created (m^2)	Costs avoided from temperature regulation	Urban population

Table notes:

1. Additional visits to wetlands have been estimated using the ORVal model which estimates the number of visits per ha to different habitat types and has been adjusted to account for the visits that would have occurred on an existing site accessible greenspace prior to the creation of an urban wetland.
2. The estimated urban cooling benefit does not account for the urban cooling provided by the greenspaces on which urban wetlands would be created. However, the urban cooling benefit provided by park/grass is about 1% of the benefit provided by wetlands (estimated from river/canals and lakes/ponds data). Therefore, a large majority of the estimated urban cooling benefit is additional (and is also an underestimate because some benefits from cooling, such as health benefits, are not measured).

4.2.2 Urban wetlands natural capital asset values

The estimated annual physical and monetary values, and present value of benefits over the 60 years for the urban wetland creation account is summarised in Table 4.3.

The accounts identify a range of benefits from urban wetlands in the UK. The value of all the benefits identified in this account have been estimated for urban wetlands in GB, whilst only the carbon sequestration benefit has been estimated for the urban wetlands in Northern Ireland. Benefits such as recreation and urban cooling are based on regional data, which was not available for Northern Ireland and therefore could not be estimated. The target to create urban wetlands in Northern Ireland will generate benefits and therefore the target area has been included in the asset register, even though the potential location of these wetlands has not yet been defined.

The account has focused on the cultural services provided by urban wetlands, such as recreation, mental and physical health benefits, given that visiting rates are anticipated to be high due to their vicinity to densely populated areas.

Table 4.3 shows annual physical flow and monetary values once the target area for urban wetland creation is reached (i.e. 2050), as well as the monetary 60-year present value (PV60) for each benefit. The PV60 represents the asset value, calculated by summing the expected future annual flow of benefits over 60 years, discounted according to HM Treasury (2020) Green Book Guidance to express in present value terms. The monetary values reported in 2050 have also been discounted according to HM Treasury Green Book Guidance (2020). Based on the discount factor applied, values in 2050 are approximately 50% lower than the values would be in the baseline year (i.e. 2024).

The main values in the urban wetland creation account (Table 4.3) are generated from the recreational benefit provided by wetlands (49% of total gross asset value) followed by physical health benefits (20% of total gross asset value) and urban cooling benefits (19% of total gross asset value). As would be expected, the recreational benefit provided by urban wetlands generates the highest value given the high number of new visits to the wetlands and the fact that all these visits will provide recreational benefits. The present value of the recreational benefit is estimated at approximately £71 million in 2050, whereas the unit value in the base year (2024) amounts to £7,124 per ha of urban wetlands created.

The other cultural services provided by wetlands that have been estimated in this account include physical health and mental health benefits. In contrast to the recreational benefits associated with wetlands, the physical health benefits provided by wetlands will only be

provided to those that visit the wetlands at least once a week for more than 30 minutes and the mental health benefits will only be provided to a subset of visitors who also have a mental health condition (MHC). The mental health benefits generated from visits to newly created wetlands (2% of total asset value) reflect the benefits accrued to those with diagnosed mental health conditions and therefore excludes the mental health benefits that may be provided to the wider population from visits to wetlands. These wider mental health benefits might include reducing stress and improving mood in visitors without an MHC diagnosis (American Psychological Association, 2020). However, given the difficulty in quantifying these benefits in the wider visitor population, they have not been included in this natural capital account and it is therefore recognized that the reported mental health benefits from visits to wetlands are an underestimate. The physical health benefit is estimated to have a present value of approximately £26 million in 2050, whereas the unit value in the base year (2024) amounts to £1,547 per ha of urban wetlands created. The mental health benefit associated with the creation of urban wetlands amounts to a present value of approximately £2 million in 2050, whilst the unit values in the base year (2024) amounts to £175 per ha of urban wetlands created.

The urban cooling benefit provided by the creation of urban wetlands based on the avoided labour productivity losses avoided during hot weather events as a result of the cooling effect (eftec et al., 2018). The costs avoided through an improvement in temperature regulation amount to a present value of £27 million in 2050 and a unit value of £14,601 per ha in the base year (i.e. undiscounted).

Table 4.3: Summary of benefits values in the UK urban wetland creation account

Annual overview	**Physical flow**					**Monetary value**					**PV 60 years (£m)**
Produced at: March 2024	**Monetary indicator (Unit/yr)**	Businesses	Rest of society	**Reporting (2050)**	**Confidence**	**Valuation (£m/yr)**	Businesses	Rest of society	**Reporting (2050)**	**Confidence**	**Constant baseline***
Key monetised benefits											
Carbon sequestration	CO_2e sequestered by wetlands (tCO_2e)	-	84,131	84,131	🟢	Non-traded carbon price	-	15	15	🟢	632
Recreation	Recreation visits to created wetland, visits/year	-	22,231,330	22,231,330	🟡	Welfare value for created wetland	-	71	71	🟢	2,808
Mental health	Avoided MHC cases from visits to nature, no. avoided MHC cases			2,379	2,379	🔴	Avoided medical treatment costs of MHC cases	-	0.9	0.9	🔴	37
							Avoided productivity loss costs of MHC cases	0.8	-	0.8	🔴	32
Physical health	Active visits to nature, active visits/year	-	10,001,048	10,001,048	🟡	Avoided medical treatment costs	-	26	26	🟡	1,117
Urban cooling	Area of urban wetland created, m^2	45,251,603	-	45,251,603	🔴	Costs avoided from temperature regulation	27	-	27	🔴	1,074
Material non-monetised benefits: biodiversity, water quality and supply, and flood risk.						**Total value**			**141**		**5,700**

Table notes:
* PV estimates for carbon sequestration have trend assumptions included as part of valuation process.

The quality of the data used for physical and monetary estimates for each benefit is assessed using the rating described in Table 4.4.

Table 4.4: Assessment of confidence in physical and monetary benefit estimates

Level of confidence	Symbol	Description of confidence
Low	🔴	Evidence is partial and significant assumptions are made so that the data provides only order of magnitude estimates of value to inform decisions and spending choices.
Medium	🟡	Science-based assumptions and published data are used but there is some uncertainty in combining them, resulting in reasonable confidence in using the data to guide decisions and spending choices.
High	🟢	Evidence is peer reviewed or based on published guidance so there is good confidence in using the data to support specific decisions and spending choices.
No colour	⚫	Not assessed

4.3 Natural Capital Liabilities

The liabilities in the natural capital account reflect the expected costs of urban wetland creation and maintenance. These costs were estimated in a study by eftec which looked at the average one-off capital costs (CAPEX) and operating costs (OPEX) of freshwater wetlands in England (eftec, 2015). It has been assumed that these costs also apply in Scotland, Wales, and Northern Ireland.

The CAPEX costs for creating freshwater wetlands in England amount to approximately £16,491/ha and the maintenance costs of these wetlands (i.e. OPEX) total approximately £181/ha/year in 2024 prices. The target urban wetland creation area in the asset register is 25,002 ha created over the next 27 years, which equates to 926 ha of wetland up to 2050. This amounts to a net cost of approximately £15.2 million per year up to 2050, after which no more wetland is created and hence no additional CAPEX costs are incurred. The costs associated with maintaining the wetlands (i.e. OPEX) increase annually as the area of wetland increases each year up to 2050, after which the undiscounted annual costs amount to approximately £4.5 million per year in 2024 prices. The present value costs of wetland creation and maintenance over a 60-year period total approximately £346 million.

5 Account results

The asset values estimated are reported in the natural capital balance sheet. The asset values are separated into private benefits and benefits to wider society. Asset values are calculated by summing the expected future annual flow of benefits over 60 years. Where possible, future values take into account expected trends in the quantity and/or value of the benefit. Where this information is not available, benefits are assumed to be constant over time – this assumption increases the uncertainty of the results, the implications of which are reported in Section 6.

5.1 GB urban wetland NCA balance sheet

Table 5.1 reflects the distribution of benefits and liabilities to businesses and wider society. In this account, the benefits to businesses from the creation of urban wetlands amounts to £1.1 billion and the benefits to society amount to £4.6 billion (assessed over 60 years in present value terms). The main benefits arise from carbon sequestration, recreation, physical health, mental health, and urban cooling.

In general, there is moderate confidence in both the physical and monetary flow estimates, with present value estimates having greater uncertainty due to assumptions on future trends. Key gaps and uncertainties for the accounting boundary include:

- The unquantified benefits listed in Table 5.1 which are expected to be material. As detailed in Section 1.2, this NCA is part of wider collection of accounts and some of the material unquantified benefits in this account will be valued in subsequent work.
- The geographic boundaries of the account exclude Northern Ireland due to the limited availability of open-source data, but further work should be done to include Northern Ireland.

The liabilities associated with the cost of creating and maintaining urban wetlands in the UK are estimated at £346 million over the next 60 years, which is approximately 6% of the value of the benefits. These costs might fall to business or wider society, depending on the responsible stakeholder, but have been allocated to businesses in the account. Accounting for these costs, the total net asset value of urban wetland creation in the UK is approximately £5.4 billion.

Table 5.1: Urban wetland creation natural capital asset valuation for Great Britain, PV60 £m

2024 prices	Valuation metric	Value to businesses	Value to the rest of society	Total
Asset values (monetised)				
Carbon	Value of CO_2e sequestered by wetlands	-	632	632
Recreation	Welfare value for created wetland	-	2,808	2,808
Mental health	Avoided medical treatment costs of MHC cases	-	37	37
	Avoided productivity loss costs of MHC cases	32	-	32
Physical health	Avoided medical treatment costs	-	1,117	1,117
Urban cooling	Value of temperature regulation	1,074	-	1,074
Total gross asset value	**Mix of values**	**1,106**	**4,594**	**5,700**
Liabilities				
Wetland creation costs[2]		(272)	**-**	(272)
Wetland maintenance costs		(74)	**-**	(74)
Total net asset values (monetised)		**760**	**4,594**	**5,354**
Other material unquantified benefits				
Water quality				
Water supply				
Flood mitigation				
Biodiversity				

Table notes:

[1] Value of carbon sequestered increase over time in line with HM Treasury Appraisal Guidance (DESNZ, 2023)

[3] Costs that are necessary to produce benefits (e.g. urban wetland habitat creation and maintenance costs).

6 Conclusions and recommendations

The urban wetland creation account can be used to (1) provide an evidence base for different groups and decision-makers to refer to on the size of the potential benefits provided by urban wetland creation, and (2) provide useful information to help manage natural capital assets, but more information on site-specific opportunity costs and benefits of urban wetlands is needed.

As has been shown in the account results, urban wetlands have multiple benefits, but the predominant purpose of these wetlands is to improve the wellbeing people living in urban areas. Benefits to the wellbeing of urban populations has been shown through the large recreational and physical health benefits provided by wetlands, as well as the urban cooling benefit provided by wetlands to urban populations. Although the mental health benefits are smaller than the other quantified benefits estimated in the account (largely because the population with mental health conditions is smaller than the population that can benefit from improving their physical health) these are nonetheless an important service provided by urban wetlands.

Improvements to the account:

The following suggestions are made to improve future analysis in the accounts.

1. **Extend the accounting boundary to the entirety of the UK**: Due to a lack of data, Northern Ireland has not been included in this account. More work could be done to identify the areas in Northern Ireland that would benefit most from the creation of wetlands.
2. **Refine asset and benefit data:** More work could be undertaken to refine certain data, particularly the condition of assets (i.e. wetlands) and the unquantified benefits associated with these assets. More detailed modelling of the all the benefits covered in this account would increase the certainty of the results, but key areas are:
    a. The condition of wetlands in this account have qualitatively been assumed to be of good condition given that these are newly created wetlands that are intended to be maintained over the relevant period. Further work could be done to identify the area of potential wetlands in SSSIs and the SSSI condition, as well as the WFD rating of wetlands based on the surrounding ratings.
    b. There are several material benefits that have been unquantified in this account, including ecosystem services such as water quality, water supply, and flood mitigation provided by wetlands. These benefits will be quantified in subsequent accounts that focus of wetlands with the purpose of improving water quality and to protect against flooding. Hence to avoid double counting, these benefits have not been estimated in this account, but further work could be done to estimate these benefits in a way that avoids double counting with the subsequent accounts.

3. **Better understanding is needed of future trends in benefits from natural capital, including those caused by climate change:** The economic value of the benefits provided by natural capital assets is the values aggregated over time based on the assumption that the assets are maintained to provide those benefits over time. Expected future changes in the quantity and/or value of benefits are reflected in the estimates where relevant data is available (such as factoring in the increasing value of mitigating carbon emissions). However, there is insufficient data to represent some expected future changes (such as increased heat in urban areas caused by climate change which would increase the value of urban cooling provided by urban wetlands) in the account. While management effort is made to maintain natural capital assets it is not certain that current maintenance costs will be sufficient to maintain the natural capital assets in the long term, particularly in the face of climate change.
4. **Develop a natural capital risk register:** An assessment of future risks and pressures is suggested to identify what actions can be taken to address those and how much these actions will cost. This will help address the points above, going forward, as well as help identify potential sources of finance for different actions.

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Appendix 1 – Benefit methodologies

This appendix describes our approach to quantifying and valuing the benefits provided by urban wetlands in the UK accounting boundary. The analysis covers the physical and monetary flows of the benefits listed in Section 4.2.1.

A1.1 Carbon sequestration

Carbon sequestration from created wetlands is estimated according to the amount of carbon sequestered by wetlands and the non-traded carbon price of carbon.

Wetlands are assumed to sequester the same amount of carbon as floodplains, which amounts to 3.365 tonnes of carbon dioxide equivalent (CO_2e) per hectare (ha) per year (Gregg et al., 2021). This is then multiplied by the area of wetland created each year. The sequestration rates are assumed to remain constant over time.

The amount of CO_2e sequestered is then valued following the DESNZ (2023) for the non-traded central price, £269 per tonne of CO_2e in 2024. This is multiplied by the estimated tonnes of CO_2e sequestered. Future flows of carbon are valued using the DESNZ (2023) carbon values series until 2050. Following DESNZ (2023) advice, a real annual growth rate is then applied starting at the most recently published value for 2050 and into the future.

A1.2 Recreation

Recreational benefit is measured in terms of number of additional visits to wetlands and the average welfare value associated with these visits.

The ORVal (Day and Smith, 2018) tool is used to estimate the number and welfare value of visits to newly created urban wetlands. To estimate visit numbers more accurately for urban wetlands, which are in the vicinity of highly populated areas, the ORVal heatmapping functionality was used. The ORVal heatmap was used to estimate the number of new visits to fen marshes[5] located near urban areas in each region of England and Wales. This provided average visit numbers per ha of fen marsh for each region. This was then multiplied by the area of urban wetland in each region to estimate the visit numbers in each region.

The new visit numbers to fen marshes generated in ORVal does not consider whether these fen marshes have been created on existing accessible green spaces. If a wetland is created on an existing accessible green space the number of visits to the newly created wetland would not all be additional as this site would have had existing visits. To account for this, the proportion of wetlands created on existing accessible green spaces was estimated for each region in GB. The visit numbers modelled in ORVal were then adjusted by reducing the number of visits to fen marshes in each GB region by the proportion of wetland created on

[5] ORVal does not have a 'wetland' habitat type. Therefore, 'fen marshes' have been used as a proxy.

existing accessible greenspaces in that region.

It should be noted that the data from ORVal takes into account the location of the recreation asset, surrounding population, habitat type(s) and local alternatives, but makes the assumption that wetlands (or fen marshes) are in average condition for its type. Where this is not the case, areas with better/ worse condition than average will likely have higher/ lower values (respectively) for number and welfare value of visits. Similarly, as the model underlying ORVal is based on MENE data, it does not take into account visits by children or overseas visitors to the UK. It should also be noted that the data in ORVal is only provided for England and Wales. Visit numbers in Scotland were therefore assumed to be the same as visit numbers in the northeast of England.

The welfare value per visit is estimated by extracting from ORVal the welfare values associated with visits to fen marshes (Day and Smith, 2018). The estimated welfare value per visit to fen marshes is then multiplied by the estimated number of visits to fen marshes. The welfare value from visits to fen marshes is assumed to be transferrable to wetlands.

A1.3 Mental health

The mental health benefit from visits to wetlands is estimated according to the number of avoided cases of mental health conditions (MHCs) from visits to nature and the value associated with avoided treatment costs and avoided productivity loss from these avoided cases of MHCs.

The number of new visits to wetlands has been estimated using ORVal, as detailed above in the calculation of recreation benefits from visits to wetlands. The number of visits to wetlands have been adjusted according to the proportion of wetlands being created on existing accessible greenspace. This adjustment ensures that the number of visits to wetlands are additional (see Physical Health, below) and therefore the benefits associated with those visits are also additional. Visits to outdoor greenspace of 30 minutes or more per week could reduce the prevalence of MHCs by 7% (Shanahan et al., 2016). This reduction in the prevalence of MHCs is assumed to be the same for visits to wetlands.

The proportion of visits to natural environments which last more than 30 minutes at least once per week have been estimated to account for 51.5% of all visits to nature (White et al., 2016). This proportion of visits that are considered ‘active’ is based on data from visits to a range of natural environments including town parks, allotments, woodlands, and **inland waters**, and therefore provides an average of the level of activity across these natural environments. To convert the number of visits into the number of visitors it has been assumed that 52 visits per year account for one visitor given that a visitor must be visiting at least once per week, as there are 52 weeks in a year. The proportion of visitors with the three commonest MHCs (namely depression, anxiety, and CMD-NOS) are assumed to be the same as the proportion of the population with MHCs. According to ONS data, 3.3% of the population has been diagnosed with depression, 5.9% has been diagnosed with anxiety, and 7.8% has been

diagnosed with common mental health disorder not otherwise specified (CMD-NOS).

These proportions of prevalence of MHCs have been adjusted in two ways. Firstly, the numbers are regionally based on UK regional mental health data. For example, the North East of England has 14% higher prevalence of antidepressant prescribing than the rest of the UK, so the prevalence of depression increases from 3.3%, which is the national average, to 3.8% in the North East. Conversely, London has prevalence of antidepressant prescribing, which is 14% lower than the national average, which therefore means that the rate of depression in London is 2.8%. Secondly, it has been estimated that approximately 26% of mental health conditions co-occur, meaning that a single person may be diagnosed with multiple MHCs. The estimated number of MHC is therefore adjusted to account for this co-occurrence.

The rate of each MHC in each region are multiplied by the number of visitors to wetlands in each of those regions. The number of visitors to wetlands with MHCs is then multiplied by the proportion of these people that are likely to benefit from visiting nature, which has been estimated to be 7% of MHC cases (Shanahan et al., 2016). This generates the number of avoided MHC cases from visits to wetlands.

The value of these avoided MHC cases is estimated based on the avoided treatment costs of MHCs (i.e. treatment-based costs) and the avoided productivity loss from a reduction in MHC cases (i.e. employment related costs). Treatment-based and employment-based costs estimate the costs of treating a single MHC diagnosis in a single patient. They therefore need to account for the co-occurrence of MHC mentioned above (Saraev et al., 2021). Treatment-based costs have been adjusted by Saraev et al. (2021) based on the percentage of individuals with depression, anxiety, and CMD-NOS that actually seek and receive treatment for their MHCs. Treatment-based costs include the cost of visits to GPs, prescribed drugs, inpatient care, supported accommodation and social services, as well as contact with a range of professionals and other costs (Saraev et al., 2021). Employment-based costs are estimated according to the average annual working days lost from individuals with depression or anxiety (Saraev et al., 2021). The treatment-based and employment-based costs are then added and multiplied by the number of avoided MHC cases to estimate the total avoided costs from visits to wetlands.

A1.4 Physical health

There are physical health benefits associated with ‘active’ visits to nature, where an ‘active visit’ is defined as those who met recommended daily physical activity guidelines either fully, or partially, during visits. White et al., (2016) estimate that 51.5% of visits to nature are ‘active’. This proportion of visits that are considered ‘active’ is based on data from visits to a range of natural environments including town parks, allotments, woodlands, and **inland waters**, and therefore provides an average of the level of activity across these natural environments.

The White et al., (2016) proportion of active visits is applied to the annual visits to wetlands within the account boundary, producing the number of annual active visits which is assumed

to remain constant over time.

The benefit is valued as the health benefits of active recreation (in terms of improvements in Quality Adjusted Life years – QALYs) and the economic value of health improvement (in terms of the avoided health cost due to improvement in QALY). Some of these health benefits will have been accounted for in the mental health benefits estimated above. To avoid double counting the avoided health treatment costs, the number of people benefitting from active visits to nature has been adjusted.

As detailed above, 51.5% of visits to nature are active, and, of these visits, 13% are visits assumed to be by people with MHCs (i.e. at the same rate as for all visitors). Given that the benefits of visiting nature to those with MHCs have already been accounted for, the avoided treatment costs per QALY will partly double count those avoided costs (along with avoided costs of non-MHC treatments costs). Therefore, the proportion of active visits to nature with physical health benefits has been estimated by removing 13% of the 51.5% of active visits, giving 45% of all visits. In removing double counting in this way results in an underestimation of the physical health treatment costs avoided.

Beale et al. (2008) analysed Health Survey for England data, estimating that 30 minutes a week of moderate-intense physical exercise, if undertaken 52 weeks a year, would be associated with 0.0106768 QALYs per individual per year. Beale et al. (2008) assume this relationship between physical activity and QALYs is both cumulative and linear. Claxton et al. (2015) estimate a cost-effectiveness threshold of a QALY to be roughly £12,900/QALY in 2008 prices. This figure is used as a proxy for health costs, reflecting the avoided health costs when QALY is improved by one unit. Based on this information, the avoided health cost per active visit is estimated as £3.87 in 2024 prices. The monetary unit value is assumed to remain constant over time.

A1.5 Urban cooling

Green and blue spaces in and around urban areas regulate temperature and humidity including ventilation and transpiration (Haines-Young and Potschin, 2018). This mitigates the heat island effect in urban areas by providing urban cooling through the temperature regulating services of green and blue spaces. The urban cooling benefit is measured according to the area of wetland located around 11 city regions and the temperature change provided by these wetland areas. The cooling effect is monetised as the cost savings from air conditioning and the avoidance of labour productivity loss due to heat (eftec et al., 2018).

The eftec (2018) study measured the urban cooling benefits provided by five different habitat types (namely woodland, park/grass, gardens, rivers/canals, and lakes/ponds) in 11 city regions (Cardiff, Edinburgh, Glasgow, Greater Manchester, Liverpool, London, North East, Sheffield, West Midlands, West of England, West Yorkshire). The target area of urban wetlands in each of the city regions was estimated by summing the area of wetlands in each of the relevant local authorities. For example, the area of wetland creation in the London City

Region involved summing the area of wetlands that could be created in the 32 local authorities in London. The eftec et al., (2018) study measured the temperature change (in degrees Celsius) provided by each type of habitat in each of the city regions based on the total area of that habitat type in the city region.

The most relevant habitat types in the eftec et al., (2018) study to the wetlands being assessed in this account are the river/canals and the lakes/ponds. The proportion of the overall temperature change attributed to river/canals and lakes/ponds are small given that these habitats make up a small proportion of the overall green and blue space in urban areas. However, the temperature change attributable to these habitats on a per area (i.e. per m^2 of the overall green and blue space) basis is higher. The reason urban blue spaces provide greater cooling to the surrounding area on per area basis than some of the other habitat types is: (1) cooling effect of evaporation from the waterbody; (2) absorbing heat, especially where the water body has a large mass; and (3) the dynamic process of transporting heat out of an area by moving it, for example, rivers (eftec, 2018; Kleerekoper et al., 2012).

The eftec (2018) study estimated the monetary value of the temperature changes in each city region based on the air condition (AC) cost savings and the avoidance of labour productivity loss from heat (eftec, 2018). Please review the study for details on how these have been estimated. The estimated monetary value in each city region was allocated to each habitat type based on the contribution of each habitat type to temperature changes per area of that habitat type in a city region. Based on this estimate, river/canals contributed between 24% and 38% of the monetary value whilst lakes/ponds provided between 2% and 3% of the value, depending on the relevant city region. The estimated monetary value of each habitat type in each city region was then divided by the area of that habitat type in each city region to estimate a unit value (i.e. £/m^2). This unit value was uplifted using a GDP deflator to 2024 prices and multiplied by the area of wetlands created in each city region.

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